FILE C

Mathematics

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Item Information and Scoring Guide Reference Sheet

The following pages are designed to assist you in understanding how Maine Educational Assessment (MEA) mathematics items are scored. These pages contain the text for each released item accompanied by the following information.

Multiple-Choice Items

The boxes containing the multiple-choice items also contain the percent of students statewide who chose each answer option. The correct option is asterisked(*).

- **MC#:** the multiple-choice item position in the Class Analysis Report
  One point may be earned for a multiple-choice item.
- **Key:** the letter of the correct answer for the multiple-choice item
- **Calculator:** indication of whether a calculator was an allowed tool in the session during which the item was administered
- **Cluster:** the cluster the item measured
- **Content Standard:** the content standard that the item measured
- **Performance Indicator:** the performance indicator that the item measured

Short-Answer Items

- **SA#:** the short-answer item position in the Class Analysis Report
  Up to two points may be earned for a short-answer item.
- **Calculator:** indication of whether a calculator was an allowed tool in the session during which the item was administered
- **Cluster:** the cluster the item measured
- **Content Standard:** the content standard that the item measured
- **Performance Indicator:** the performance indicator that the item measured
- **Short-Answer Scoring Guide:** the description of each score point used to determine the score, including the percent of students statewide who received each score and the statewide average student score
- **Training Notes:** in-depth descriptions or particular information used to determine the score
- **Annotated Student Response:** sample student response for each score point with annotations that explain the reasoning behind the assigned score

Item Information and Scoring Guide Reference Sheet

Constructed-Response Items

- **CR#:** the constructed-response item position in the Class Analysis Report
  Up to four points may be earned for a constructed-response item.
- **Calculator:** indication of whether a calculator was an allowed tool in the session during which the item was administered
- **Cluster:** the cluster the item measured
- **Content Standard:** the content standard that the item measured
- **Performance Indicator:** the performance indicator that the item measured
- **Constructed-Response Scoring Guide:** the description of each score point used to determine the score, including the percent of students statewide who received each score and the statewide average student score
- **Training Notes:** in-depth descriptions or particular information used to determine the score
- **Annotated Student Response:** sample student response for each score point with annotations that explain the reasoning behind the assigned score

MEA 2005–2006

Mathematics Grade 8

The table below shows the entire MEA mathematics test design. Half of the common items are released and can be found in this document. Item information for all item types, scoring information (average scores, guides, and training notes) for all short-answer and constructed-response items, and annotated student responses follow.

2005–2006 MEA MATHEMATICS TEST DESIGN

Content Area	Common			Embedded Field Test			Total Items per Student			Base Testing Time	Points
	MC	CR	SA	MC	CR	SA	MC	CR	SA		
Mathematics	32	3	6	8	2	2	40	5	8	105 min.	56

Each item on the MEA measures a content standard and performance indicator based on Maine's *Learning Results.* Score points for items are accumulated and reported in clusters. Each content standard is included in a cluster as indicated below.

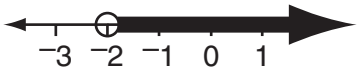
Mathematics Clusters

1. Numbers and Operations
- Numbers and Number Sense
- Computation
- Discrete Mathematics

2. Shape and Size
- Geometry
- Measurement

3. Mathematical Decision Making
- Data Analysis and Statistics
- Probability
- Mathematical Reasoning

4. Patterns
- Patterns, Relations, and Functions
- Algebra Concepts
- Mathematical Communication



1. Which inequality describes this graph?

*50%	A. $x > -2$
21%	B. $x \geq -2$
20%	C. $x < -2$
9%	D. $x \leq -2$

MC#: 1
Key: A
Calculator: Not Allowed
Cluster: Patterns
Content Standard H: Algebra Concepts - Students will understand and apply algebraic concepts.
Performance Indicator: H5 - Students will be able to demonstrate an understanding of inequalities and non-linear equations.

2. Melissa's credit card company charges $1\frac{1}{2}\%$ monthly interest on each end-of-month balance. How much interest will Melissa be charged if her end-of-month balance is $200?

18%	A. $ 1.50
*44%	B. $ 3.00
20%	C. $15.00
18%	D. $30.00

MC#: 2
Key: B
Calculator: Not Allowed
Cluster: Numbers and Operations
Content Standard B: Computation - Students will understand and demonstrate computation skills.
Performance Indicator: B1 - Students will be able to compute and model all four operations with whole numbers, fractions, decimals, sets of numbers, and percents, applying the proper order of operations.

3. It takes 3 cups of flour to make 2 dozen cookies. How much flour is needed to make 7 dozen cookies?

5%	A.	$4\frac{2}{3}$ cups
9%	B.	6 cups
*75%	C.	$10\frac{1}{2}$ cups
10%	D.	12 cups

MC#: 3
Key: C
Calculator: Not Allowed
Cluster: Numbers and Operations
Content Standard B: Computation - Students will understand and demonstrate computation skills.
Performance Indicator: B2 - Students will be able to create, solve, and justify the solution for multi-step, real-life problems including those with ratio and proportion.

4. a. List all of the whole-number factors of 12.

   b. Circle the factors of 12 that are prime numbers.

SA#: 4
Calculator: Not Allowed
Cluster: Numbers and Operations
Content Standard A: Numbers and Number Sense - Students will understand and demonstrate a sense of what numbers mean and how they are used.
Performance Indicator: A3 - Students will be able to apply concepts of ratios, proportions, percents, and number theory (e.g., primes, factors, and multiples) in practical and other mathematical situations.

SHORT-ANSWER SCORING GUIDE

Percentage of Statewide Student Scores	Score	Description
10%	2	2 Points
52%	1	1 Point
34%	0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
4%	Blank	No response.
.73	Statewide average student score.	

Training Notes for Short-Answer Item 4

Part a: 1 point for correct answer, 1, 2, 3, 4, 6, 12

Part b: 1 point for correct answer only the 2 and 3 should be circled

Sample 2-Point Response with Annotations for Short-Answer Item 4

4.

Summary annotation statement:

The student earns 1 point in part a for correctly listing all of the whole-number factors of 12. The student earns another point in part b for circling the correct prime numbers “2” and “3”. Using the scoring guide, 2 total points is a score point 2.

Sample 1-Point Response with Annotations for Short-Answer Item 4

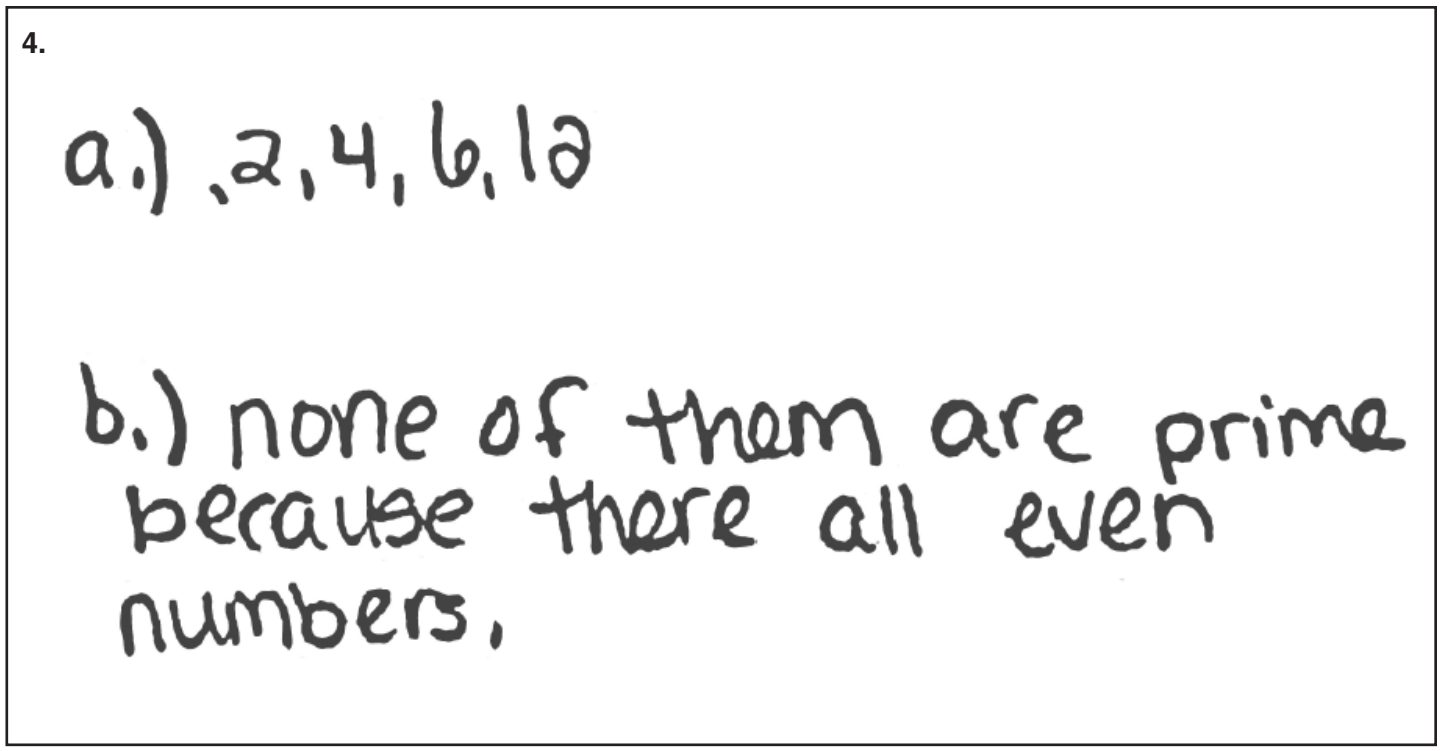
4.

Summary annotation statement:

The student earns 1 point in part a for correctly listing all whole-number factors for 12. The student earns no points in part b because he or she circled "1" as a prime number incorrectly. According to the scoring guide, 1 total point is a score point 1.

Sample 0-Point Response with Annotations for Short-Answer Item 4

4.



Summary annotation statement:

The student attempts to answer parts a and b, but provides incorrect answers.

5. Mark made a presentation to his middle school principal asking him to increase the number of fun nights offered by the school. Which argument in favor of this request is the **least** biased?

10%	A.	"80% of the eighth graders I asked want more fun nights."
23%	B.	"All my friends and I want the change."
*55%	C.	"I surveyed a random sample of students, and 80% would like more fun nights."
12%	D.	"Players on the basketball team want more fun nights."

MC#: 5
Key: C
Calculator: Allowed
Cluster: Patterns
Content Standard K: Mathematical Communication - Students will reflect upon and clarify their understanding of mathematical ideas and relationships.
Performance Indicator: K2 - Students will be able to use statistics, tables, and graphs to communicate ideas and information in convincing presentations and analyze presentations of others for bias or deceptive presentation.

6. Which expression represents a number that is three less than twice d?

5%	A. $3 + 2d$
31%	B. $3 - 2d$
*58%	C. $2d - 3$
6%	D. $\frac{d}{2} - 3$

MC#: 6
Key: C
Calculator: Allowed
Cluster: Patterns
Content Standard K: Mathematical Communication - Students will reflect upon and clarify their understanding of mathematical ideas and relationships.
Performance Indicator: K1 - Students will be able to translate relationships into algebraic notation.

7. The population of a country is estimated at 1.04×10^9 people. Which number is closest to 1.04×10^9?

13%	A.	1 million
18%	B.	100 million
*46%	C.	1 billion
22%	D.	10 billion

MC#: 7
Key: C
Calculator: Allowed
Cluster: Numbers and Operations
Content Standard A: Numbers and Number Sense - Students will understand and demonstrate a sense of what numbers mean and how they are used.
Performance Indicator: A1 - Students will be able to use numbers in a variety of equivalent and interchangeable forms (e.g., integer, fraction, decimal, percent, exponential, and scientific notation) in problem-solving.

8. Which expression shows the prime factorization of 40?

29%	A. $4 \times 10 \times 1$
20%	B. 8×5
11%	C. $2 \times 3 \times 5$
*39%	D. $2^3 \times 5$

MC#: 8
Key: D
Calculator: Allowed
Cluster: Numbers and Operations
Content Standard A: Numbers and Number Sense - Students will understand and demonstrate a sense of what numbers mean and how they are used.
Performance Indicator: A3 - Students will be able to apply concepts of ratios, proportions, percents, and number theory (e.g., primes, factors, and multiples) in practical and other mathematical situations.

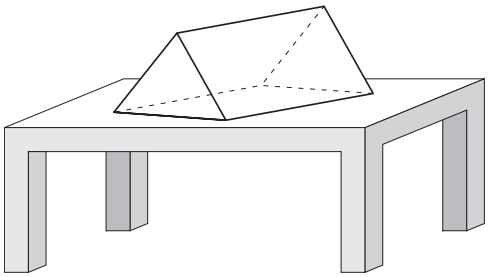
9. Which ordered pair satisfies the following equation?

$$y = 4x - 3$$

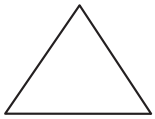
*43%	A.	$(0, -3)$
24%	B.	$(3,0)$
21%	C.	$\left(0, \frac{-3}{4}\right)$
10%	D.	$\left(\frac{-3}{4}, 0\right)$

MC#: 9
Key: A
Calculator: Allowed
Cluster: Patterns
Content Standard H: Algebra Concepts - Students will understand and apply algebraic concepts.
Performance Indicator: H6 - Students will be able to find solutions for unknown quantities in linear equations and in simple equations and inequalities.

10. Lisa placed a **triangular right prism** on a table as shown below.



If she traces around the face of the prism that touches the table, what shape will she have drawn?

9% A. 

*66% B. 

22% C. 

2% D. 

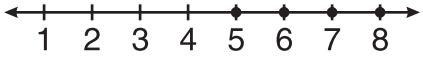
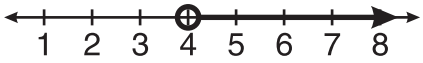
MC#: 10
Key: B
Calculator: Allowed
Cluster: Shape and Size
Content Standard E: Geometry – Students will understand and apply concepts from geometry.
Performance Indicator: E1 - Students will be able to compare, classify, and draw two dimensional shapes and three dimensional figures.

11. Jake read in the newspaper that one U.S. dollar was worth $1.53 in Canadian money. If n stands for a number of U.S. dollars, which equation gives the value, v, of those dollars in Canadian money?

19%	A.	$v = n + 1.53$
10%	B.	$v = n - 1.53$
17%	C.	$v = \frac{n}{1.53}$
*54%	D.	$v = 1.53n$

MC#: 11
Key: D
Calculator: Allowed
Cluster: Patterns
Content Standard H: Algebra Concepts - Students will understand and apply algebraic concepts.
Performance Indicator: H1 - Students will be able to use the concepts of variables and expressions.

12. Which graph shows the solution for the inequality $x > 4$ when x is a real number?

4%	A.	
16%	B.	
*50%	C.	
30%	D.	

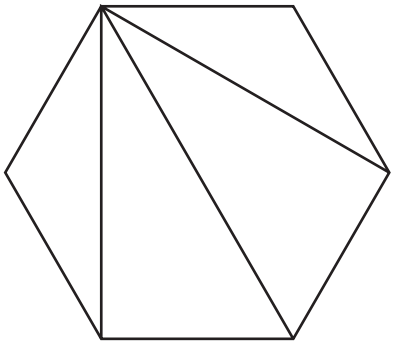
MC#: 12
Key: C
Calculator: Allowed
Cluster: Patterns
Content Standard H: Algebra Concepts - Students will understand and apply algebraic concepts.
Performance Indicator: H6 - Students will be able to find solutions for unknown quantities in linear equations and in simple equations and inequalities.

13. Which equation when graphed is not a straight line (is nonlinear)?

*46%	A.	$y = 2x^2 + 4$
15%	B.	$y = 3x$
19%	C.	$y = 2x + 5$
19%	D.	$y = 4$

MC#: 13
Key: A
Calculator: Allowed
Cluster: Patterns
Content Standard H: Algebra Concepts - Students will understand and apply algebraic concepts.
Performance Indicator: H5 - Students will be able to demonstrate an understanding of inequalities and non-linear equations.

14. The figure below is a regular hexagon with diagonals drawn from one of its vertices.



What kinds of triangles are formed by the diagonals and the sides of this regular hexagon?

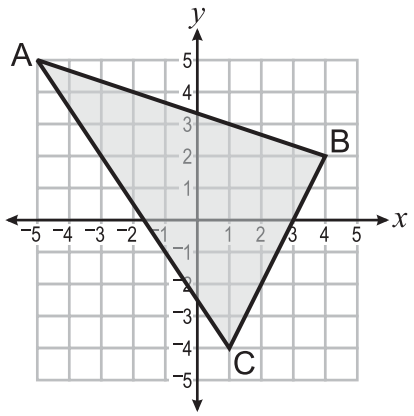
16%	A. 4 acute triangles
7%	B. 4 obtuse triangles
*41%	C. 2 obtuse and 2 right triangles
36%	D. 2 obtuse and 2 acute triangles

MC#: 14
Key: C
Calculator: Allowed
Cluster: Shape and Size
Content Standard E: Geometry – Students will understand and apply concepts from geometry.
Performance Indicator: E1 - Students will be able to compare, classify, and draw two dimensional shapes and three dimensional figures.

15. Joelyn has decided to save $12 a week to buy a stereo system that costs $125. Which expression shows how much money she will still have to save after *n* weeks?

19%	A.	$125 + 12n$
*53%	B.	$125 - 12n$
14%	C.	$(125 + 12)n$
13%	D.	$(125 - 12)n$

MC#: 15
Key: B
Calculator: Allowed
Cluster: Patterns
Content Standard H: Algebra Concepts - Students will understand and apply algebraic concepts.
Performance Indicator: H1 - Students will be able to use the concepts of variables and expressions.



16. Which of the following are coordinates of a point located on a side of triangle ABC?

20%	A.	(0,3)
*51%	B.	(−3,2)
16%	C.	(3,1)
11%	D.	(−2,2)

MC#: 16
Key: B
Calculator: Allowed
Cluster: Shape and Size
Content Standard E: Geometry – Students will understand and apply concepts from geometry.
Performance Indicator: E3 - Students will be able to use a coordinate system to define and locate position.

17. At Handy Rentals, a car rents for $45 per day plus 20 cents per mile driven. If c is the cost in dollars of the rental and m is the number of miles the car is driven, which equation represents the cost for renting and driving that car for one day?

*71%	A.	$c = 45 + 0.20m$
10%	B.	$c = 45m + 20$
9%	C.	$m = 45c + 0.20$
9%	D.	$m = 45 + 0.20c$

MC#: 17
Key: A
Calculator: Allowed
Cluster: Patterns
Content Standard G: Patterns, Relations, Functions – Students will understand that mathematics is the science of patterns, relationships, and functions.
Performance Indicator: G1 - Students will be able to describe and represent relationships with tables, graphs, and equations.

18. Between 1770 and 1780 the population of Maine **increased** by about 60%. If the population in 1770 was 31,300, what was the population (to the nearest hundred) in 1780? Show or describe the steps you used to find your answer.

SA#: 18
Calculator: Allowed
Cluster: Numbers and Operations
Content Standard I: Discrete Mathematics – Students will understand and apply concepts in discrete mathematics.
Performance Indicator: I2 - Students will be able to identify patterns in the world and express these patterns with rules.

SHORT-ANSWER SCORING GUIDE

Percentage of Statewide Student Scores	Score	Description
10%	2	Student correctly responds, 50,100, and provides work or explanation that shows appropriate strategy.
28%	1	Student gives correct answer, but does not show any work. OR Student shows correct strategy with computation error or does not round to the nearest 100.
57%	0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
5%	Blank	No response.
.48	Statewide average student score.	

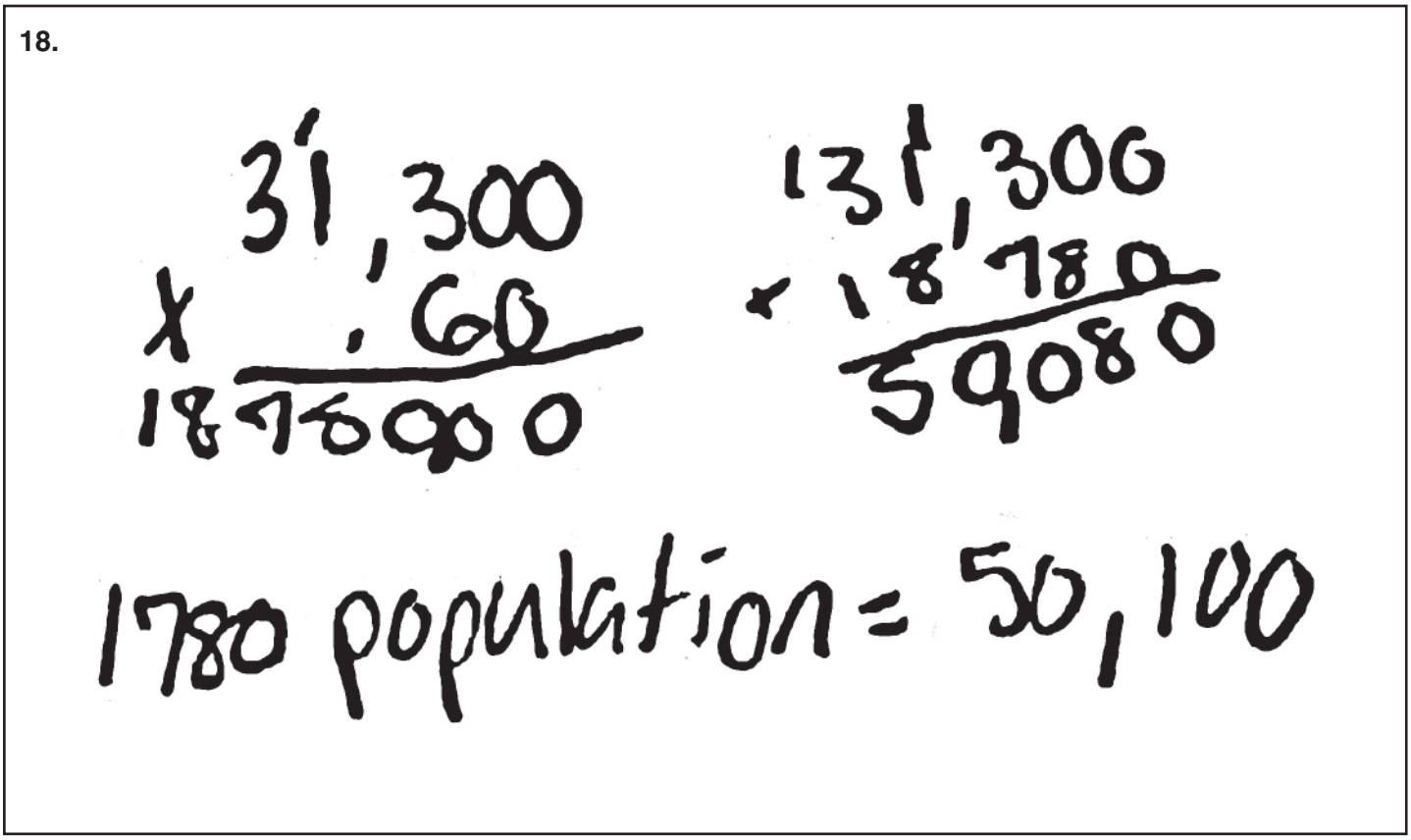
Training Notes for Short-Answer Item 18

Sample Response
1.6 × 31,300 = 50,080 rounded to the nearest 100 is 50,100

Note: Do not give strategy point if student's answer is more than double the original population of 31,300.

Sample 2-Point Response with Annotations for Short-Answer Item 18

18.

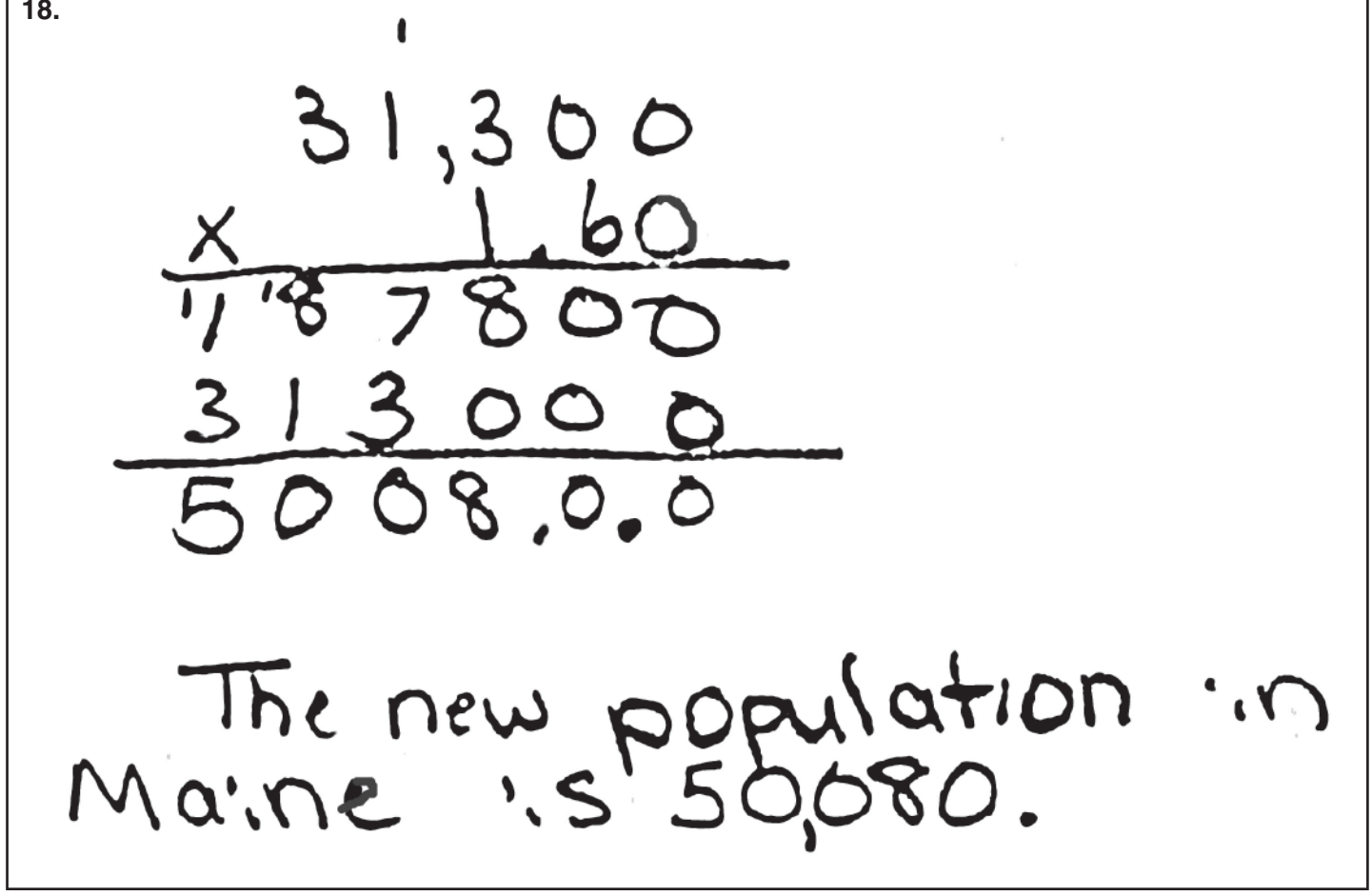


Summary annotation statement:

The student earns 2 points for providing the correct answer rounded to the nearest 100, with correct work and strategy shown. According to the scoring guide, the student earns a score point of 2.

Sample 1-Point Response with Annotations for Short-Answer Item 18

18.

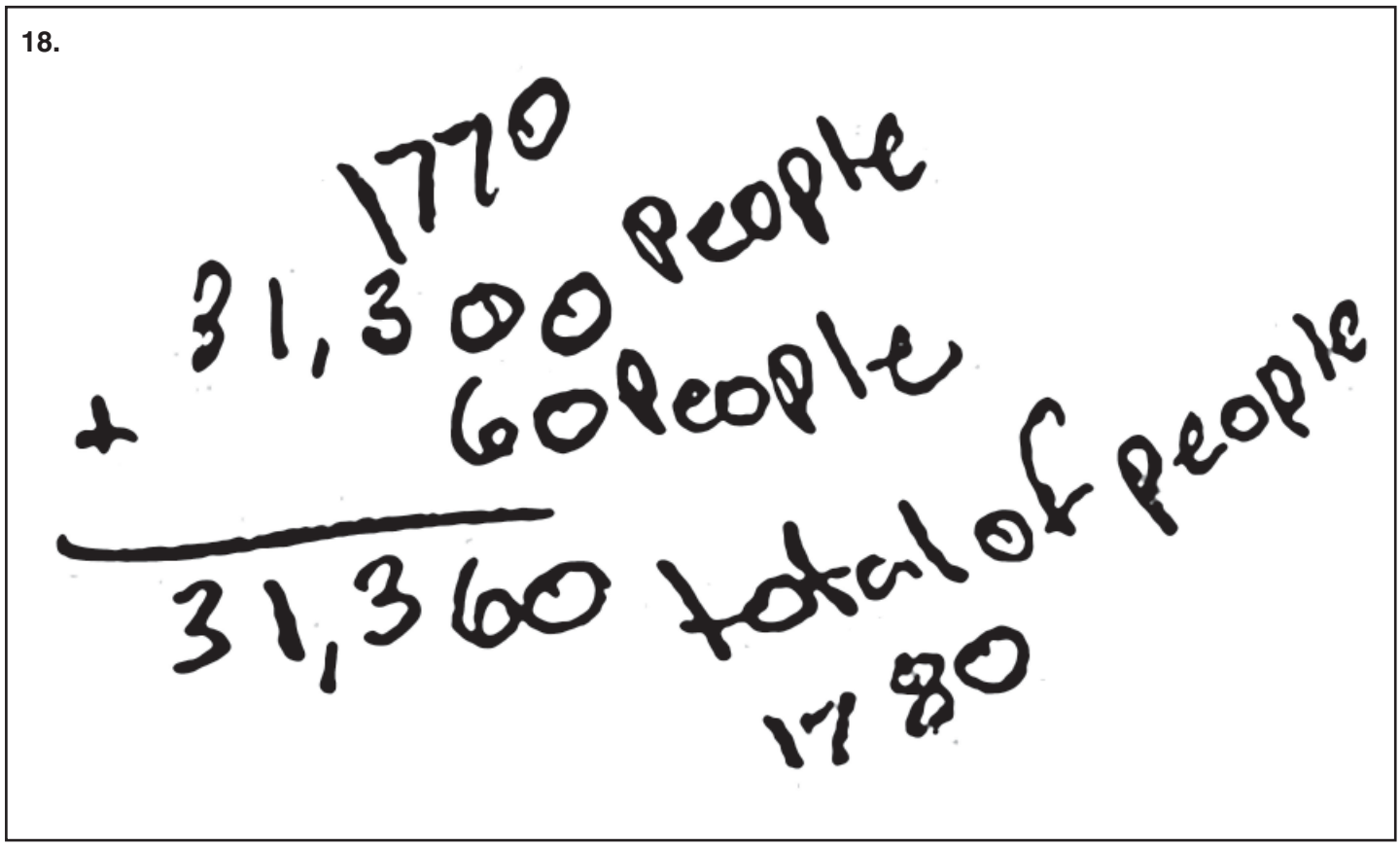


Summary annotation statement:

This response earns 1 point for providing the correct strategy, but the final answer is not rounded to the nearest 100. According to the scoring guide the student earns a score point of 1.

Sample 0-Point Response with Annotations for Short-Answer Item 18

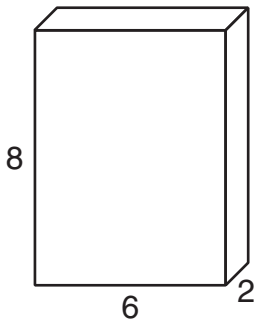
18.

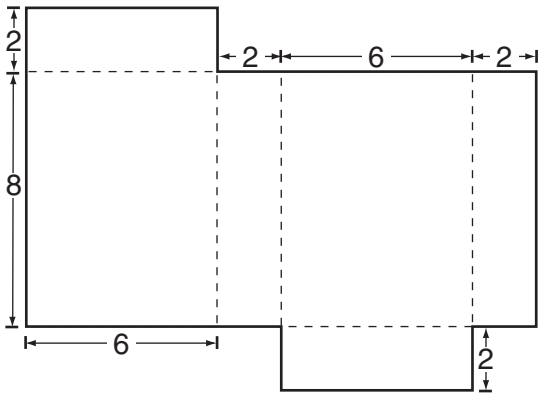


Summary annotation statement:

The student provides both an incorrect answer and strategy.

19. The pattern (without overlaps) of a box is shown below. The dimensions are given in inches.





a. How many cubic inches of sugar can this box hold? Show your work or explain how you found your answer.

b. If the cardboard costs $0.0004 per square inch, what is the cost of the cardboard for one box? Show your work or explain how you found your answer.

CR#: 19
Calculator: Allowed
Cluster: Shape and Size
Content Standard F: Measurement – Students will understand and demonstrate measurement skills.
Performance Indicator: F3 - Students will be able to demonstrate an understanding of length, area, volume, and the corresponding units, square units, and cubic units of measure.

CONSTRUCTED-RESPONSE SCORING GUIDE

Percentage of Statewide Student Scores	Score	Description
10%	4	Student demonstrates excellent problem-solving skills and thorough understanding of measurement of geometric solids by correctly solving a real-world problem and correctly computing the surface area and volume of a rectangular solid.
7%	3	Student demonstrates good problem-solving skills and understanding of measurement of geometric solids by solving a real-world problem and computing the surface area and volume of a rectangular solid with only minor errors.
35%	2	Student demonstrates inconsistent problem-solving skills and understanding of measurement of geometric solids by completing a significant portion of required tasks.
8%	1	Student showed minimal understanding of surface area or volume by showing some correct solution strategy.
34%	0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
6%	Blank	No response.
1.39	Statewide average student score.	

Training Notes for Short-Answer Item 19

Score	Description
4	5 points
3	4 points OR 3 points with some credit for finding volume and surface area
2	2 or 3 points
1	1 point
0	Response is totally incorrect or correct only in ways irrelevant to what is being measured.
Blank	No response.

Part a: 2 points for the correct answer, **96 cubic inches**, and work or explanation to show appropriate strategy.
Volume = 2×6×8=96 *cubic inches*

OR

1 point for the correct answer with no strategy shown.

or

for correct strategy with a computation error.

Part b: (Maximum 3 points)

2 points for the correct answer, **152 square inches**, and work or explanation to show appropriate strategy.
Surface area = (2 × 2 × 6) + (2 × 6 × 8) + (2 × 2 × 8) = 152 *square inches*

OR

1 point for the correct answer with no strategy shown.

or

for correct strategy with a computation error.

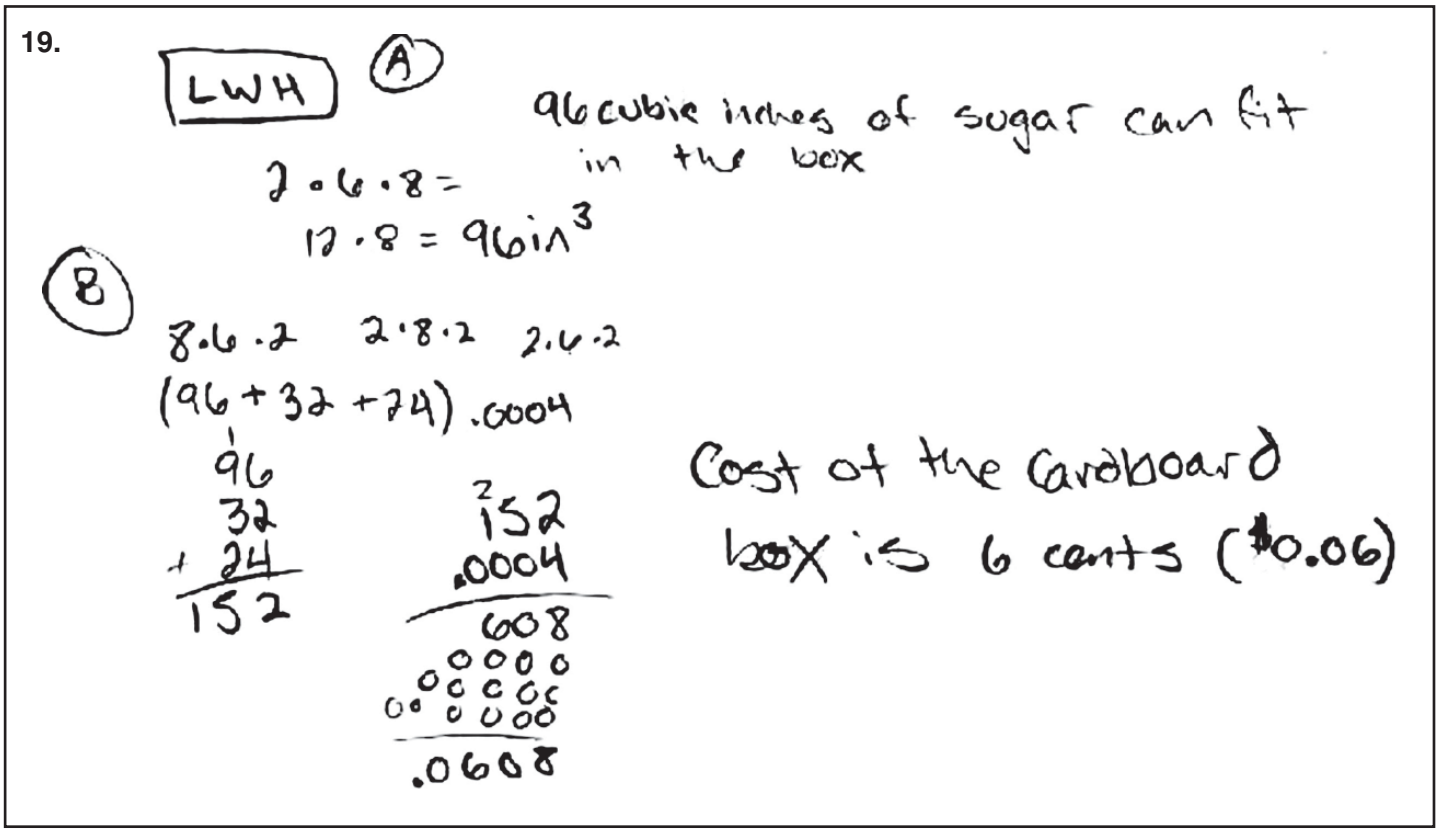
AND

1 point for correct answer, **$0.06 or $0.061 or $0.0608 or correct based on incorrect surface area**

Cost = 152 × $0.0004 = $0.0608 ≈ $0.06

NOTE: If either or both of the units of measure are incorrect in parts a and b, score cannot be a 4; otherwise, do not penalize. If units are missing do not penalize.

Sample 4-Point Response with Annotations for Constructed-Response Item 19

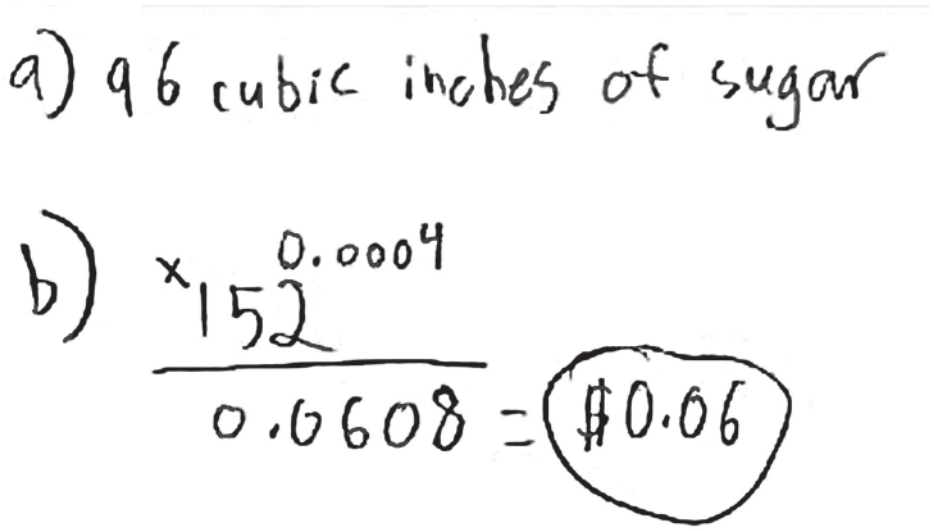


Summary annotation statement:

This student's response demonstrates a thorough understanding of measurement of geometric solids. The student earns 2 points in part a for correctly calculating the volume of the box and providing the correct work. In part b he or she earns 3 points for finding the correct surface area of the box and the cost of the cardboard. According to the scoring guide, 5 total points earns a score point 4.

Sample 3-Point Response with Annotations for Constructed-Response Item 19

19.

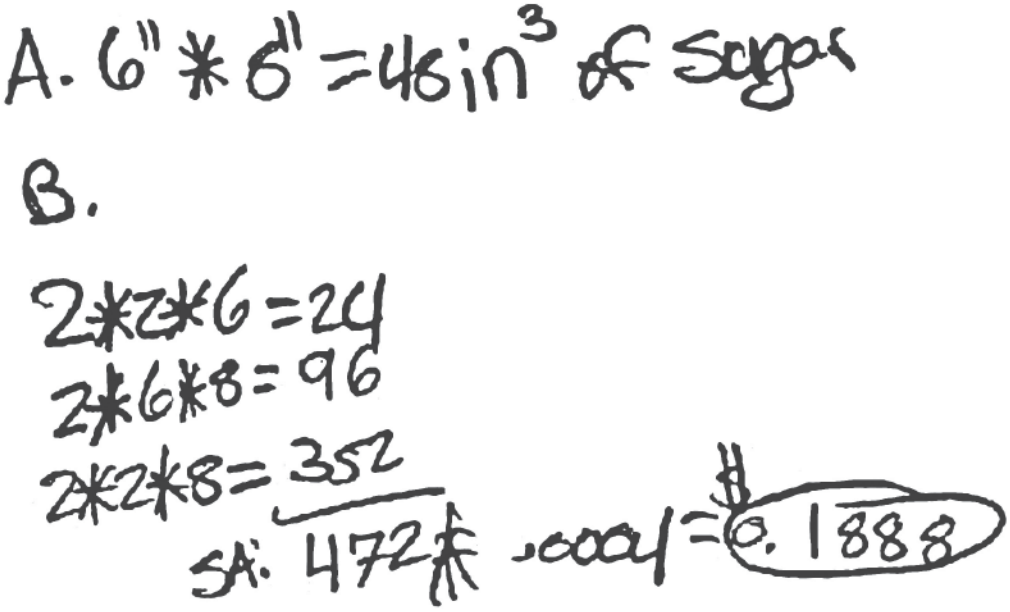


Summary annotation statement:

The student earns 1 point in part a for the correct answer with no work provided. He or she earns 2 points in part b for finding the correct surface area with no work and calculates the cost of the cardboard. According to the scoring guide, 3 total points earns a score point 3.

Sample 2-Point Response with Annotations for Constructed-Response Item 19

19.

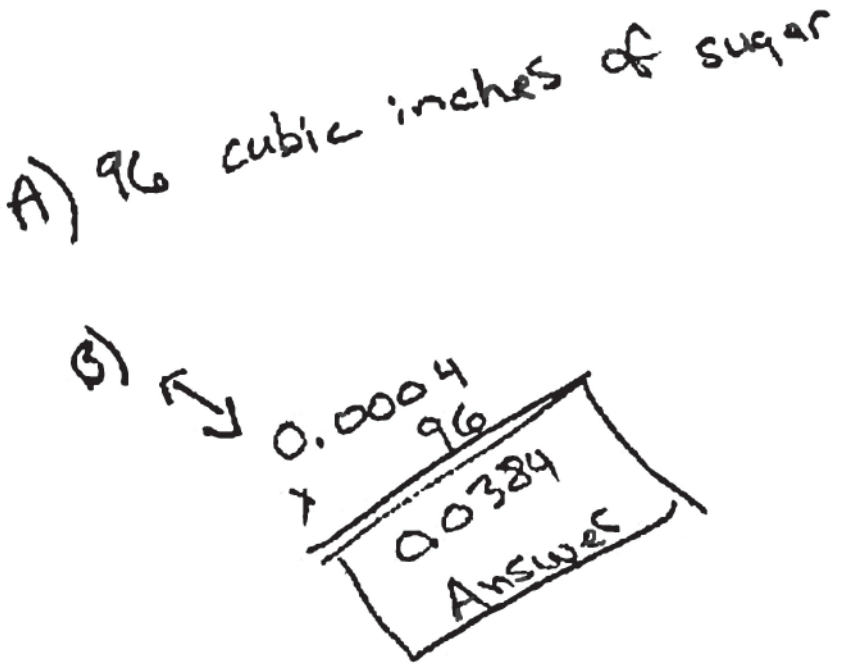


Summary annotation statement:

This student earns no points in part a, as he or she incorrectly calculated the volume. In part b the student earns 1 point for using the correct strategy, and 1 point for finding the cost of the cardboard correctly based on an earlier error. Using the scoring guide, 2 total points earns a score point 2.

Sample 1-Point Response with Annotations for Constructed-Response Item 19

19.

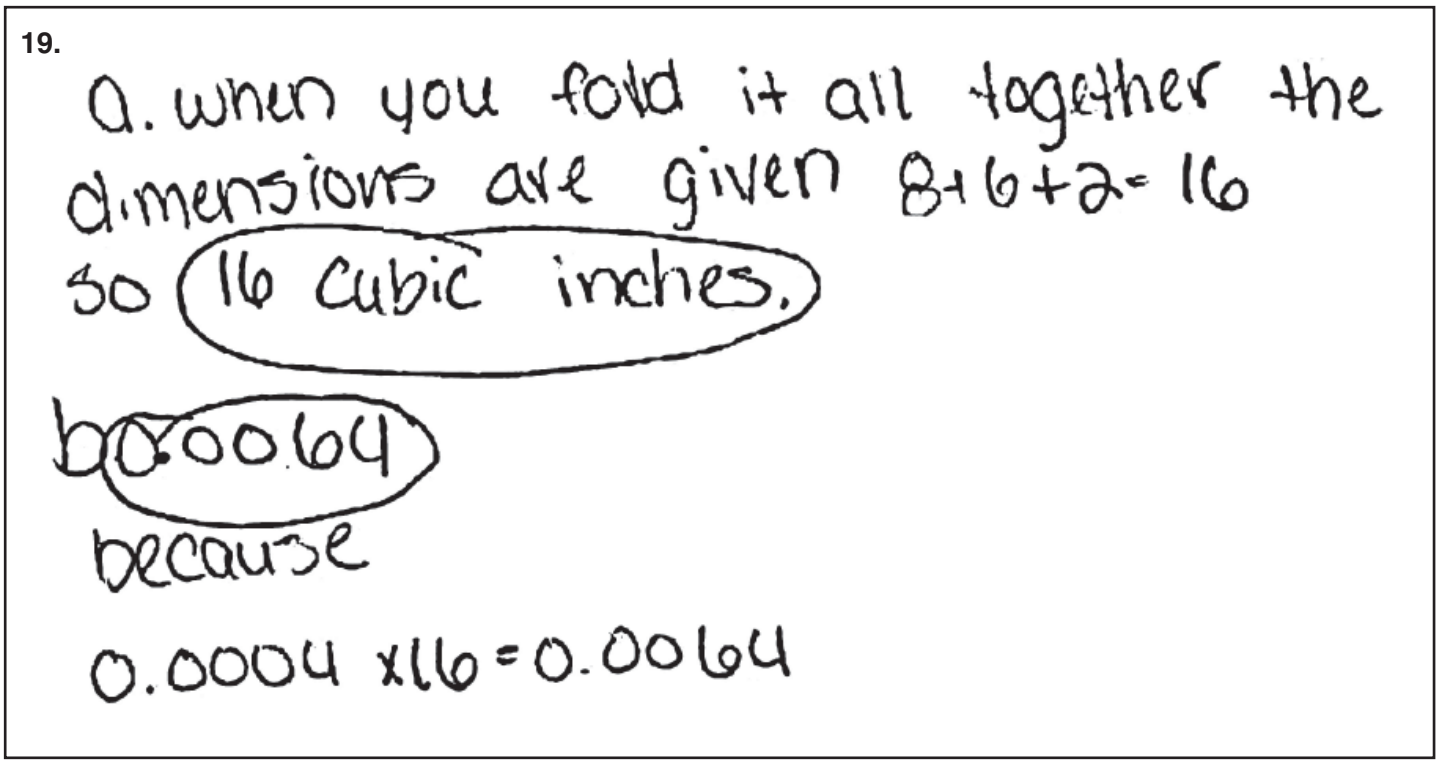


Summary annotation statement:

The student earns 1 point in part a for providing the correct volume with no work included. In part b the student did not calculate the surface area and incorrectly multiplied volume by $0.0004, and receives 0 points. According to the scoring guide, 1 total point earns a score point of 1.

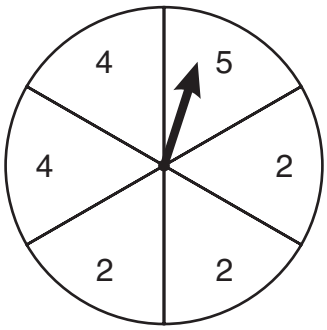
Sample 0-Point Response with Annotations for Constructed-Response Item 19

19.



Summary annotation statement:

The student incorrectly calculates answers for parts a and b.



20. Bonnie knows that probability can be represented as a fraction between and including zero and one.

    a. What is the probability of this event: the spinner lands on a section labeled 4?

    b. What does it mean to have a probability of zero?

    c. Describe a spinner event that would have a probability of zero.

    d. What does it mean to have a probability of one?

    e. Describe a spinner event that would have a probability of one.

CR#: 20
Calculator: Allowed
Cluster: Mathematical Decision Making
Content Standard D: Probability – Students will understand and apply concepts of probability.
Performance Indicator: D2 - Students will be able to explain the idea that probability can be represented as a fraction between and including zero and one.

CONSTRUCTED-RESPONSE SCORING GUIDE

Percentage of Statewide Student Scores	Score	Description
14%	4	Student demonstrates a thorough understanding of probability by correctly describing events that meet specific requirements and by correctly computing the probability of a described event.
6%	3	Student demonstrates a general understanding of probability by describing events that meet specific requirements and by computing the probability of a described event with only minor errors or omissions.
51%	2	Student demonstrates a basic understanding of probability by performing a significant portion of the required tasks.
17%	1	Student demonstrates minimal understanding of probability.
10%	0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
2%	Blank	No response.
1.91	Statewide average student score.	

Training Notes for Constructed-Response Item 20

Score	Description
4	5 points
3	4 points
2	2–3 points
1	1 point OR Student shows minimal understanding of probability.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No Response.

Part a: 1 point correct answer (2/6 or equivalent).

Part b: 1 point explanation that a probability of zero means the event will not happen.

Part c: 1 point description of an event using a spinner that has a probability of zero.

Part d: 1 point explanation that a probability of 1 means the event will happen.

Part e: 1 point description of an event using a spinner that has a probability of one.

Sample Events for parts c and e:

Part c: Spin a nine.
(Since there is no 9, the probability is 0.)
OR
P (a letter)
(There aren't any letters so it's impossible.)

Part e: "a number"
(Spinner will always land on a number.)
OR
Spin a number less than 6
(Every number is less than 6.)

Sample 4-Point Response with Annotations for Constructed-Response Item 20

20.

A) The probability is $\frac{1}{3}$ because it can come up 2 out of 6 spins $\frac{2}{6} = \frac{1}{3}$ 1/3 is the same as 1 out of 3 tries

B.) Having a probability if zero means the event will never happen.

C.) If the event was get a number less than 2, there are no numbers less than two on the spinner so it won't happen.

D) Having a probability of one means the event will always happen.

E. If the event was to get a number higher than one, since all the numbers are higher than one the event will always happen.

Summary annotation statement:

This student's response demonstrates a thorough understanding of probability and earns 1 point for each correct answer provided in parts a, b, c, d, and e. Using the scoring guide, 5 total points earns a score point of 4.

Sample 3-Point Response with Annotations for Constructed-Response Item 20

20.

a. $\frac{2}{6}=\frac{1}{3}$

b. there is no chance of it happening

c. The probability of the spinner landing on 10 is 0

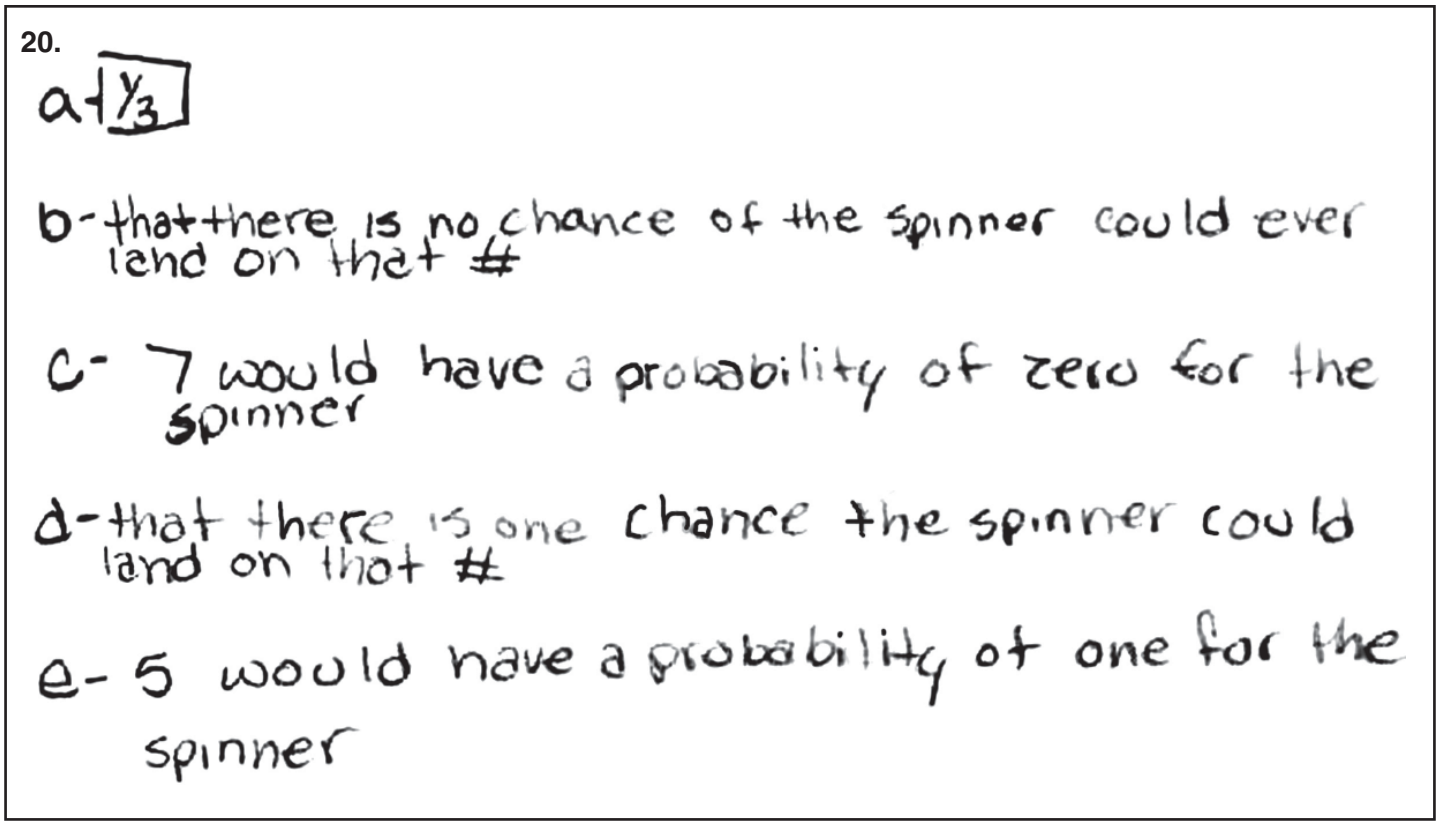
d. The spinner will always land on it.

e. There is no chance for the spinner having the probability of 1

Summary annotation statement:

This student's response demonstrates general understanding of probability by providing the correct answer or explanation for parts a, b, c, and d and earning 1 point for each. The student receives no points in part e for the incorrect answer with lack of a valid example of a probability of 1 event occurring. According to the scoring guide, 4 total points earns a score point of 3.

Sample 2-Point Response with Annotations for Constructed-Response Item 20



Summary annotation statement:

The student earns 1 point for providing the correct answer in part a, 1 point for providing a correct explanation in part b, 1 point for correctly describing an event with zero probability in part c. Parts c and d are both incorrect answers. According to the scoring guide, 3 total points earned is a score point 2.

Sample 1-Point Response with Annotations for Constructed-Response Item 20

20.

A. 2/6

B. The spinner lands on something not there

C. none because there is no spinner

D. 9/6

E. none because there is no one.

Summary annotation statement:

The student earns 1 point in part a for the correct answer, and no points in parts b, c, d, or e for providing an incorrect example or explanation. According to the scoring guide, 1 total point earns a score point 1.

Sample 0-Point Response with Annotations for Constructed-Response Item 20

20.

a. It is more likely to land on four than any other number.

b. that theres a less chance for it to land on zeve.

C. that is would have mass zeros.

d. there is only one one.

e. thos it would be less likely to land on zero.

Summary annotation statement:

The student provides incorrect answers and explanations for all parts of the question.